REMARKS

This application has been carefully reviewed in light of the Final Office Action, dated November 26, 2009. Claims 12 to 15 remain in this application. Claim 12 is the independent Claim. It is believed that no new matter is involved in the arguments presented herein.

Reconsideration and entrance of the amendment in the application are respectfully requested.

Interview Summary

Applicant thanks the Examiner for the courtesy of the telephone interview conducted on May 25, 2011. The substance of the arguments presented by the Applicant and the issues raised by the Examiner during the interviews are incorporated in this response.

Applicant respectfully submits that, as discussed during the interview, the claims presented in the instant application are in condition for allowance.

Art-Based Rejections

Claims 12-14 were rejected under 35 U.S.C. § 102(b) over U.S. Patent Publication No. 2003/0049487 (Katsuki) or U.S. Patent Publication No. 2003//017041 (Oguni).

Applicant respectfully traverses the rejections and submits that the claims herein are patentable in light of the arguments below.

The Claims are Patentable Over the Cited References

The present application is generally directed to a thermoplastic polyimide resin film.

As defined by independent Claim 12, a resin film includes a thermoplastic polyimide resin having a surface shape formed on at least one of the surfaces thereof. The surface shape has a Ra1 value of arithmetic mean roughness of 0.05 μm to 1 μm measured with a cutoff value of 0.002 mm, and a Ra1/Ra2 ratio of 0.4 to 1 and a Ra2 value measured with a cutoff value of 0.1 mm.

The applied references do not disclose or suggest the above features of the present invention as defined by independent Claim 12. In particular, the applied references do not disclose, teach or even suggest, "a resin film comprising a thermoplastic polyimide resin having a surface shape formed on at least one of the surfaces thereof, the surface shape having a Ra1 value of arithmetic mean roughness of 0.05 μm to 1 μm measured with a cutoff value of 0.002 mm, and a Ra1/Ra2 ratio of 0.4 to 1, Ra2 being a value measured with a cutoff value of 0.1 mm," as required by independent Claim 12 of the present invention.

The Office Action conclusorily "takes the position" that the surface disclosed in the Katsuki and Oguni references reads on the inventive surface defined by Claim 12 of the present invention. (*See, Office Action, P. 3*). According to the Examiner, the adhesive properties of Katsuki and Oguni references necessarily require the features of the surface defined by Claim 12 of the present invention. (*See, Office Action, P.4*) Applicant respectfully submits that the Office Action's position in this regard is untenable.

As explained in Applicant's response to the previous office action and interviews as well as during the May 25, 2011 interview, the claimed surface of the present invention results in achieving a surface with an optimal balance between adhesiveness and micro wiring properties, which are conflicting properties.

For example, paragraph [007] of the original Specification states:

> In a printed wiring board, adhesion between a polymer film used as a substrate and a circuit is generally achieved by surface roughness called an "anchor effect". Therefore, a step of roughening a surface of

the film is generally provided for forming roughness of about 3 to 5 μm in terms of a Rz value on the surface of the substrate. Such surface roughness of the substrate is not a problem for the formed circuit having a LIs of 30 μm /30 μm or more, but the roughness is an important problem in forming a circuit having a line width with a LIS of 30 μm /30 μm or less, particularly 25 μm/25 μm or less. This is because such a microcircuit line with a high density is affected by the roughness of the substrate surface. Therefore, a technique for forming a circuit on a polymer substrate with high surface smoothness is required for forming a circuit with a L/S value of 25 μm /25 μm or less, and the smoothness must be 3 μm or less and preferably 1.5 μm or less in terms of a Rz value. In this case, however, the anchor effect cannot be expected as adhesive force, and thus improvement in adhesive strength cannot be expected. For example, a method of electroless plating on a roughened surface of an epoxy resin is disclosed as a method for roughening a resin surface (refer to, for example, Japanese publication of patent application Japanese Patent Laid-Open No. 2000-198907 official report (published on July 18,2000). However, with a surface roughness Rz of 3 μm or more, high adhesiveness can be achieved, while with a surface roughness Rz of 3 μm or less, particularly about 1 μm, an adhesiveness of only about 3 N/cm is exhibited. It is thus thought that in the conventional method of roughening a film surface, high surface roughness is required for expecting the anchor effect. Therefore, it has become necessary to develop another adhesion method.

According to paragraph [0068]:

One of the surface treatment methods includes forming irregularity on the surface of the thermoplastic polyimide resin. It is known that adhesive strength to the electroless-plated film tends to increase as the roughness of the irregular surface increases. On the other hand, the pitch of formable wiring tends to increase as the roughness of the irregular surface increases regardless of whether the wiring is formed by the subtractive method or the semi-additive method. Therefore, increases in surface roughness are undesirable for increasing the wiring density. In the present invention, the thermoplastic polyimide is selected as a material to be surface-treated, and thus the electroless-plated film can be strongly bonded in spite of its lower surface roughness than conventional surface roughness. Therefore, strong adhesion of wiring and formation of finer wiring can

be simultaneously realized, thereby complying with the need for a higher-density printed wiring board.

As disclosed in Paragraph [0070]:

> The roughness of the roughened surface of the metal foil affects the adhesive strength between the thermoplastic polyimide resin and the electroless-plated film, and the pitch of wiring formable on the thermoplastic polyimide resin. In other words, as the roughness of the metal foil increases, the roughness of the irregular surface formed on the thermoplastic polyimide resin tends to increase, and also the adhesive strength to the electroless-plated film tends to increase. On the other hand, the pitch of formable wiring tends to increase regardless of whether the wiring is formed by the subtractive method or the semi-additive method. Thus, increases in roughness are undesirable for increasing the wiring density. Specifically, the surface roughness Rz (ten-point medium height) of the roughened surface of the metal foil is preferably 3 μm or less, more preferably 2 μm or less, and most preferably 1.5 μm or less. This roughness is preferred because the surface roughness Rz of the irregular surface formed on the thermoplastic polyimide resin is also 3 μm or less, micro-wiring with a L/S of 25 μm 25 μm or less can be formed, and the adhesive strength is 5 N/cm or more. As the copper foil, an electrolytic copper foil and a rolled copper foil are widely used, and anyone of the copper foils has a roughened surface, i.e., a matte surface, on at least one surface, for increasing the adhesive strength to the resin. Also, matte surfaces with various degrees of roughness can be obtained using copper foil products, but the matte surface of the rolled copper foil can be preferably used because of its relatively low surface roughness Rz.

As the above disclosures in the original Specification make clear, the inventive surface of Claim 12 of the present invention is based on the inventors' achievement of an optimal balance between adhesive and micro wiring requirements of modern, high density micro-circuits that is defined by the values of Ra1, Ra2 and Ra1/Ra2 measured with specific cut off values. As explained in [0148] of the present Patent Application Publication,

> The Ra2 value indicates irregularity with wavelengths of 100 μm or less. Since the irregularity with wavelengths of over 100 μm possibly includes, at a high ratio, wrinkles and curls occurring in a film at the time of setting of a sample for observing the surface shape, the Ra2 value is set as a value suitable for removing irregularity which is not original irregularity of the film. On the other hand, the Ra1 value indicates irregularity with wavelengths 2 μm or less. The inventors found that as the Ra1 value increases, wiring formability in forming micro-wiring with L/S of 30 μm /30 μm or less and preferably 10 μm /10 μm or less tends to decrease. It was also found that irregularity with wavelengths of 2 μm or less tends to have lower adhesiveness unless it has a certain height, i.e., an arithmetic mean roughness value is 0.05 μm to 1 μm.

Accordingly, neither Katsuki nor Ognui disclose, teach or even suggest the above features of Claim 12 of the present invention.

Since the applied references do not disclose or suggest the above features as recited in independent Claim 12, those references cannot be said to anticipate nor render obvious the invention which is the subject matter of that claim.

Accordingly, independent Claim 12 is believed to be in condition for allowance and such allowance is respectfully requested.

The remaining claims depend either directly or indirectly from independent Claim 12 and recite additional features of the invention which are neither disclosed nor fairly suggested by the applied references and are therefore also believed to be in condition for allowance and such allowance is respectfully requested.

Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los

Angeles, California telephone number (213) 223-2365 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-5225.

Respectfully submitted,
ADLI LAW GROUP P.C.

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